BOTANICAL GAZETTE

MARCH, 1903

CONTRIBUTIONS FROM THE CRYPTOGAMIC LABORATORY OF HARVARD UNIVERSITY. LIV.

NEW OR PECULIAR NORTH AMERICAN HYPHOMYCETES. III.

ROLAND THAXTER.

(WITH PLATES IV AND V)

DURING a brief visit to Jamaica in the winter of 1890-91, the writer obtained, among numerous other interesting coprophilous forms, two peculiar genera of hyphomycetous fungi, both of which have been kept constantly in cultivation ever since. Although both these types are conspicuous, and appear to be widely distributed, no reference to either of them has been found in the literature, and it is assumed that they have been thus far overlooked.

The most striking and peculiar of these genera, to which I have given the name *Heterocephalum*, has the appearance of a very large Aspergillus, of a delicate orange-yellow color, from the head of which project numerous radiating spines or bristles, visible to the naked eye, the whole (*fig. 1*) recalling the conditions seen in Actiniceps. This resemblance is further strengthened from the fact that the spiniferous head is borne on a stalk which appears to be composed of numerous slender ascending hyphae, and at first sight one might be inclined to place the plant among the Hyalostilbeae. An examination of the early development of this fructification, however, makes it evident that it belongs to a quite different type, which appears to be, in some respects, unique among the Hyphomycetes.

The vegetative portion of the fungus consists of a copious

mycelium of rather slender septate hyphae from which the fertile hypha usually arises as a lateral branch of relatively large diameter, which becomes abruptly differentiated. As this fertile hypha commences to rise above the substratum, a number of vegetative hyphae, or branches from them, grow toward it; and, as it elongates, apply themselves closely to its surface, growing upward as it develops and more or less completely corticating it, except in the region of its free extremity. When the fertile hypha has attained its full height the free tip, ceasing to elongate, becomes abruptly swollen, forming a head much as in Aspergillus (*fig. 2*), the whole surface of which soon becomes papillate with young sporiferous branches (*fig. 3*). The corticating hyphae meanwhile, being enabled to overtake the head, apply themselves closely to its surface and begin to push between the young sporiferous branches, by which they are soon more or less completely concealed. At the same time, also, they begin to branch more or less copiously, and the extremities of these branches, growing outward with the sporophores, extend rapidly beyond them (*fig. 8*), and eventually form the radiating septate bristles above referred to. Their development, however, is not confined to mere elongation; since, just below two or sometimes three of the lowest septa, they give rise to whorls of lateral branches, which, growing tangentially, by branching and intertwining eventually form an envelope like basket-work that incloses the sporogenous branches completely, and through which the bristle-like hyphae appear to project. The sporogenous hyphae in the meantime branch successively in an irregularly umbellate fashion, the branchlets becoming more numerous as the process is repeated. The basal cells and those of the main branches become greatly enlarged, closely compacted, and more or less adherent, so that they are with difficulty crushed apart; while the ultimate branchlets of the third or fourth order bear an irregular umbel of sporiferous branchlets, from the tips of which the minute oval spores are successively abjointed (*figs. 4–7*).

The head, which strongly suggests the pseudoperithecium, if it may so be termed, of the more highly differentiated species of

Gymnoascus, is thus a remarkable combination of two elements of independent origin. The conspicuous portion, which forms the main bulk of the head, consists of sterile elements derived from sterile hyphae in the mycelium, whose development runs parallel to that of the fertile hypha and whose function is evidently connected with spore dispersion. At maturity the bristles and other sterile elements of the head become echinulate through a more or less copious deposit (of calcic oxalate?) and adhere very readily to any object which touches them; while at the same time the whole head separates at a touch from its attachment to the stalk, carrying with it the mass of spores which, though not involved in mucus, are nevertheless adherent in a more or less compact mass. The successively abjointed spores do not appear to remain united in chains, though two or three may often be seen thus adherent, and, judging from the dense contents of the compacted and firmly adherent sporogenous branches, it seems not improbable that they may continue to be abjointed even after the head has become separated from the stalk which bears it.

The spores germinate readily, and the fungus fruits abundantly on nutrient agar of various kinds, the fructifications being usually more or less gregarious, often so much so that adjacent heads adhere to one another over a considerable area and may be lifted in a continuous mat.

Although this fungus has been under cultivation for twelve years on various substrata, and under varied conditions, no ascigerous fructification has as yet made its appearance. That it belongs among the Plectascineae nevertheless, and that an ascigerous condition of this nature will eventually be found, can hardly be doubted. The same fungus has been received from another source within the past year, having fruited spontaneously in transit, on some goat's dung, in a vial hermetically sealed with wax, which was sent to my assistant, Mr. A. F. Blakeslee, from the Philippine Islands. It may thus be assumed that the plant has a wide distribution in the tropics from its independent occurrence in antipodal regions.

The second form, which I have called *Cephaliophora*, made its

appearance on a bit of mongoose dung picked up in a ravine near Kingston. It forms at first a cottony mycelium composed of septate branching hyphae of very rapid growth, which soon collapse more or less completely, sending up at intervals short branchlets which become sporophores, and under a hand lens appear to rise directly from the substratum. These sporophores consist of short, broadly clavate branches, the distal portion swollen with variable abruptness, and from the surface of the more or less distinctly differentiated head thus formed the spores arise directly as in Oedocephalum. The spores, which are fawn colored to pale chocolate-brown in the mass, are quite unlike those of other genera of this type in being multiseptate, thick-walled, and subcylindrical. The septa are transverse and commonly three in number, but vary from two to rarely as many as six. The basal cell is never functional and always colorless, and others of the cells, especially the terminal ones, are often empty at maturity, the contents becoming concentrated in the remaining segments. The mature spores have very thick walls and are able to retain their vitality air-dry for more than a year, germinating readily in water, or on nutrients, in the ordinary fashion.

Like the first type described above, this fungus has been in constant cultivation for twelve years in my laboratory without showing any signs of the production of an ascigerous condition. The same species has been obtained and cultivated, for periods ranging from two to six years, from Liberia, Africa, from Java, and from China, under conditions which leave no doubt of its origin from these localities, so that it may be assumed to be a common form of wide distribution throughout the tropics.

A second and closely allied species of the same genus was also obtained on material sent from Porto Rico, and although it was at first believed to be a mere variety of the first, its differences, after five years of cultivation, still remain so constant that its separation seems warranted. Its spores are differently shaped, and normally once, less often twice, septate, the terminal cell being relatively large and usually the only functional segment. Its habit of growth in tubes is also less luxuriant, the sporiferous hyphae forming a stringy coating on the agar, usually more or

less characteristic, while the color of the spore mass is distinctly more rufous.

HETEROCEPHALUM, nov. gen.—Vegetative mycelium consisting of fine, septate, branching, colorless hyphae growing on and in the substratum. Fertile hyphae abruptly differentiated, erect, stout, swelling distally to form a well-distinguished terminal head, the whole surface of which gives rise to sporophores several times subumbellately branched, the ultimate branchlets abjointing successively continuous hyaline spores. The fertile hypha corticated by sterile hyphae which grow upward with it, eventually forming a special envelope about the sporiferous portion of the head.

Heterocephalum aurantiacum, nov. sp.—Color pale clear orange-yellow, sometimes almost salmon colored. Sporogenous hyphae four to five times successively subumbellately branched, the irregularly bottle-shaped sporophores borne in terminal groups of about six or eight from branchlets of the third or fourth order. Spores minute, oval to oblong, somewhat irregular in size and outline. Corticating hyphae about six to ten in number, giving rise to numerous (about twenty-five to fifty, more or less) straight, rigid, bristle-like, tapering, septate branches radiating in all directions from the head, often terminating in a slight, rather abrupt, enlargement, and producing, in whorls just above their two lower septa, several lateral branchlets growing tangentially, branching and intertwining to form a spherical envelope, like basket-work, about the fertile head and coherent spore mass within; the radiating setae and their branches becoming more or less prominently echinulate at maturity. Spores about $3.5 \times 3\mu$. Fertile hyphae 1.5–3^{mm} high by 8–14μ in diameter. Radiating setae about 600–1500μ in length. Diameter of head, including spore mass, 300–375μ; including envelope, 500–750μ.

On dung of toad, Kingston, Jamaica (1890–91); on goat dung, Philippine Islands.

CEPHALIOPHORA, nov. gen.—Vegetative hyphae copious, branching, septate, colorless. Sporophores arising as short branches from the hyphae, which become more or less abruptly enlarged distally to form a variably differentiated head, from the

surface of which the spores are produced. Spores once to several times transversely septate, becoming brownish, the sterile basal segment narrowed to form a more or less distinct pedicellate attachment.

Cephaliophora tropica, nov. sp.—Sporophores very variable, the heads nearly spherical or more or less elongated, short-stalked or almost sessile. Spores hyaline, becoming fawn- to pale chocolate-brown in the mass, translucent, darker at the septa, two- to five-septate (normally three-septate), subcylindrical; the sterile basal cell tapering to a well-marked pedicellate attachment. Spores, average about $35 \times 16\mu$, maximum about 50×19–20μ. Diameter of head, average about 28–35μ. Average length of fertile branch, including head, 60–75μ.

On mongoose dung, Kingston, Jamaica; on ass dung, Liberia; on rat dung, Java; on mouse dung, China.

Cephaliophora irregularis, nov. sp.—Similar to the last; the spores in the mass more reddish-brown, the habit of growth somewhat different. Spores very variable in form and size, normally once, sometimes twice, septate; the terminal cell only (as a rule) fertile, usually broadly rounded, often broadened, and not infrequently bilobed. Average spore measurements 25–$30 \times 18\mu$, maximum about $36 \times 30\mu$.

On mouse dung, Porto Rico.

HARVARD UNIVERSITY.

EXPLANATION OF PLATES IV AND V.

The figures were drawn with camera lucida and reduced in reproduction. The approximate magnifications are as follows: *fig. 1* × 60; *figs. 2–3, 11–15, 17–19* × 390; *figs. 4–7, 10, 16* × 860; *figs. 8–9* × 100.

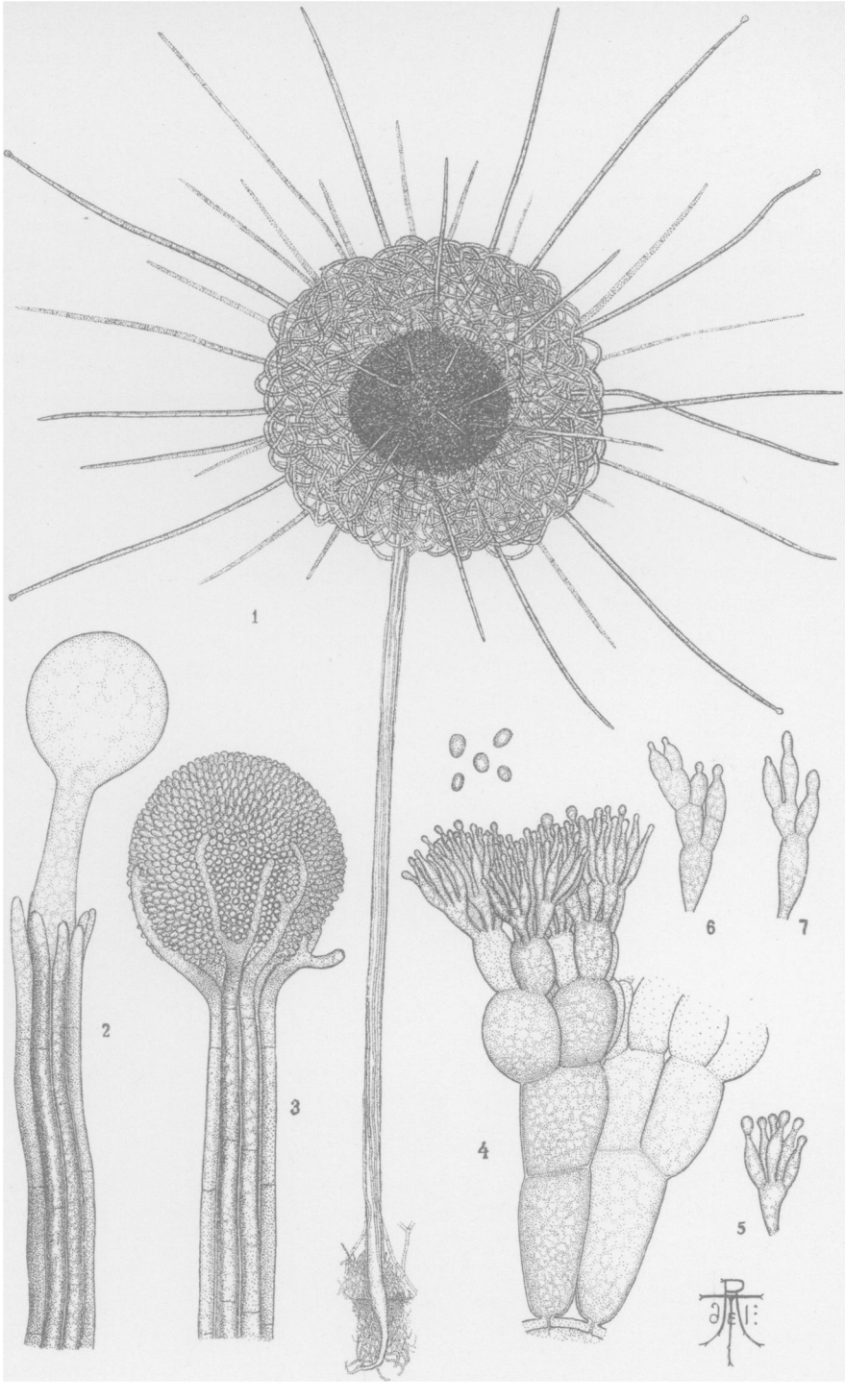
FIGS. 1–10. *Heterocephalum aurantiacum.*

FIG. 1. General habit; the dark central portion of the head represents the spore mass surrounding the sporophores.

FIG. 2. Terminal portion of a fertile hypha, its tip enlarged to form the fertile head, which has not yet been overtaken by the corticating hyphae.

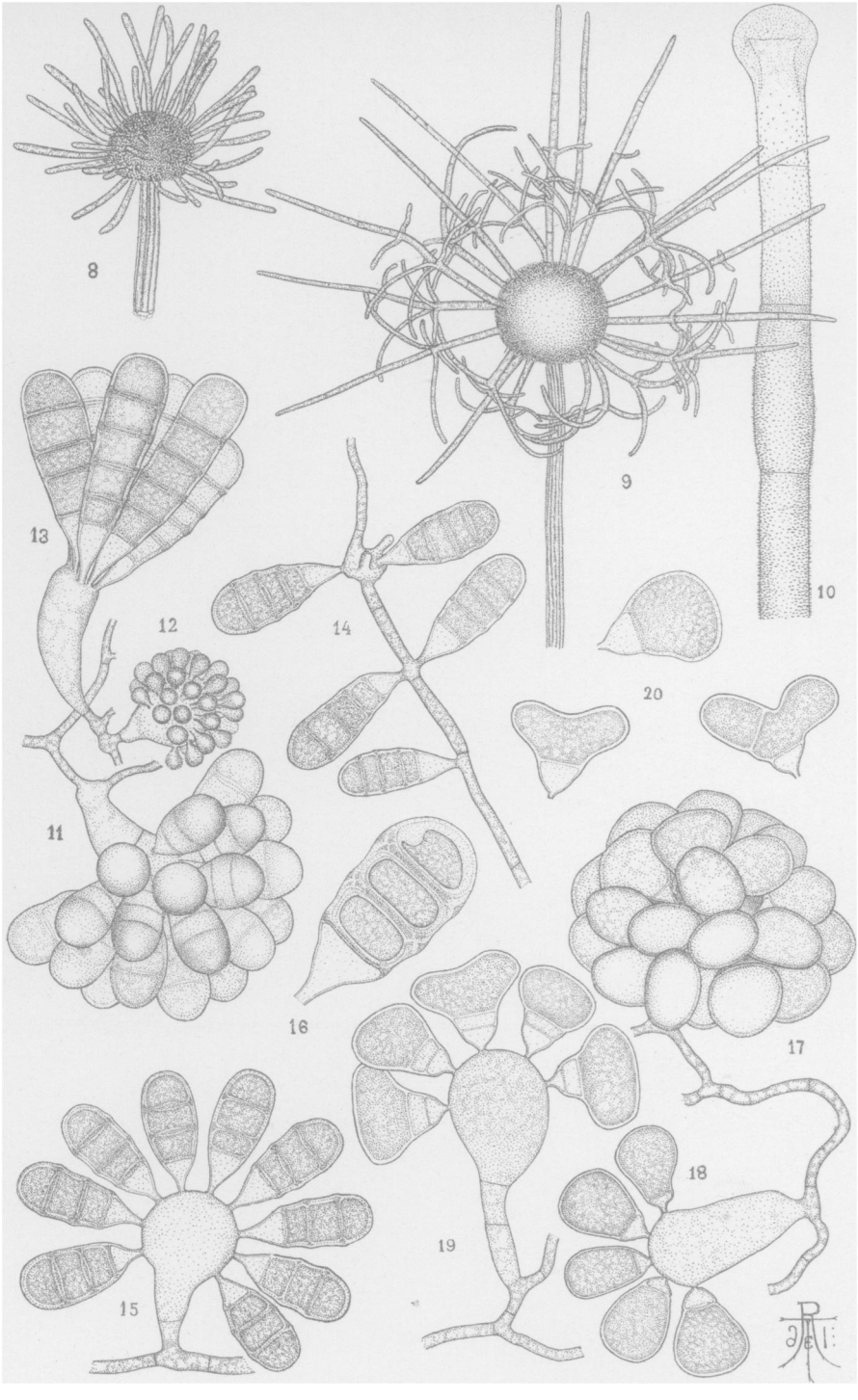
FIG. 3. Fertile head covered with young sporogenous branches, among which the branching tips of the corticating hyphae are beginning to push.

FIG. 4. Small portion of fertile head showing sporogenous branches and their origin; above, four spores.



THAXTER on HYPHOMYCETES.

HELIOTYPE CO., BOSTON.



THAXTER on HYPHOMYCETES.

FIG. 5. Branch of the fourth order bearing tuft of sporiferous branchlets.

FIGS. 6–7. Young sporogenous branches from which branchlets of the third and fourth order are budding.

FIG. 8. Young fertile head, the subclavate branches of the corticating hyphae projecting from among the young sporogenous branches.

FIG. 9. A more mature condition, in which these branches are becoming bristle-like and are giving rise to the whorls of lateral branchlets which form the sterile envelope shown in *fig. 1*.

FIG. 10. Tip of one of the mature setae, showing echinulation.

FIGS. 11–16. *Cephaliophora tropica.*

FIG. 11. Normal sporiferous head with spores *in situ*.

FIG. 12. Young head with spores just developing.

FIG. 13. Abnormally elongate head with unusually long 4–5-septate spores.

FIG. 14. Abnormal development of spores directly from the hyphae.

Fig. 15. Normal head seen in optical section.

FIG. 16. Normal fully mature spore.

FIGS. 17–20. *Cephaliophora irregularis.*

FIG. 17. Head with rather broad spores.

FIG. 18. Head in optical section showing normal spores.

FIG. 19. Head in optical section with broad biseptate spores.

FIG. 20. Three spores.